Amendments to the Specification:

Please add the following new paragraph after the title of the invention and above Field of the Invention:

[000]   This application claims the benefit of U.S. Provisional Application No. 60/413,162, filed September 25, 2002.

Please replace paragraph [0038] with the following replacement paragraph:

[0038]   Referring now to Figure 4, shown is a simplified flow diagram of another method of optimizing the shape of a positive polarity waveform according to an embodiment of the instant invention. At decision step 130, it is determined whether the at least a value, in this case the "average of the cubes", is equal to zero. If the answer at decision step 130 is yes, then at decision step 132 it is determined whether both input wave circuits are functioning correctly. By way of explanation, if the output of the waveform generator is sinusoidal, as would be the case when one of the two input sinusoidal waves is zero, then modification of the phase angle offset or the relative amplitudes of the input waves cannot change the "average of the cubes" to a non-zero value. For example, it at step ~~132~~ 130 the "average of the cubes" is zero, both input sinusoidal waves are set to a predefined value, without concern about the particular ratio of A/B. If the "average of the cubes" remains at zero, then a failure of one of the two input waves is possible. If under these conditions the phase angle offset is changed and the "average of the cubes" continues to be fixed at zero, failure of one of the input waves is certain and an error is registered at step 134. If it is determined at step 132 that both input wave circuits are functioning correctly, then the amplitudes of the two sinusoidal waveforms are set to non-zero values at step 136, and optimization of the generated asymmetric waveform shape continues.

Please replace paragraph [0042] with the following replacement paragraph:

[0042]   The method described with reference to Figures 2 to 4 above is successful because the absolute value of the <u>peak</u> voltage of the waveform is significantly different in the positive and negative polarity of the ideal asymmetric waveform. Referring again

to the normalized asymmetric waveform of positive polarity DV shown in Figure 1, the maxima 2 in the positive polarity are approximately equal to one, whereas the most negative points near 4 are approximately equal to negative one-half. The cube function, applied to all of the data points, covering all parts of the waveform, results in larger valued "cubes" for the points on the higher voltage polarity side of the waveform than the points in the opposite polarity. This tends to push the average of the cubes in the direction of the polarity of DV. It should be noted that application of this process to symmetrical waveforms (such as a sinusoidal wave) results in a zero average of cubes. This is because all points in the positive polarity are matched by a point of equal magnitude in the opposite polarity. The cubes of these two points are of equal magnitude but of opposite polarity, and therefore the average of these two points is zero. This applies to all the points of the waveform, and the net average of the cubes of a sinusoidal wave is zero.

Please replace paragraph [0046] with the following replacement paragraph:

[0046] From the foregoing discussion it becomes clear that obtaining the maximum CV for optimum transmission of an ion in FAIMS could be achieved by using the actual functional dependence of K(E) for the ion in question. If a particular ion has mobility that depends on field as $K(E) = K_L (1 + \alpha E^3)$ where α is a constant as described above, then if the "cube" algorithm is applied, the waveform generator will produce a wave that maximizes the CV of this ion. In general the functional dependence on field has been written as $K(E) = K_L (1 + \alpha E^2 + \beta E^4)$, where K_L is the mobility at low field (and has no field-dependence). With the application of the asymmetric waveform, we are therefore trying to maximize the value of the integral of K(E), which is equivalent to maximizing the integral of K(V(t)), and equivalent to maximizing the integral of $K_L(1 + aV(t)^2 + bV(t)^4)$ over one cycle of the waveform, where a and b are proportional to α and β respectively, which in turn is equivalent to maximizing $[aV(t)^2 + bV(t)^4]$ over one cycle of the waveform. In practice, this is reduced to the following algorithm. The data points of the measured signal voltages of the applied asymmetric waveform are normalized. Each point is squared and multiplied by "a", and also raised to the fourth power and multiplied by "b", and these two value are added together. Since this function is "even",

where both positive and negative input values result in an output value of the same sign, the sign of the original data point is then applied to this calculated value. The set of computed values from one cycle of the waveform is reduced to one numerical value by addition of all the points, or by averaging all the points, or by computing the equivalent of the integral of these values over this cycle of the waveform. The waveform parameters of phase angle and ratio of A/B are then modified in an iterative manner to maximize the value of this computed integral for one cycle of the waveform. This procedure will result in a waveform that is very similar to, but not necessarily *exactly* like that of equations (1) and (2). In all cases the phase angle will remain exactly $\pi/2$. The ratio of A/B will vary from 2.0 in order to maximize the CV for the particular ion that was used to produce the values of α and β, or a and b respectively. Consider some examples applied to a normalized positive polarity waveform V(t): (1) the average value of $[V(t)]^3$ will maximize at 0.111 and at this condition A/B is 2 and phase angle is $\pi/2$, (2) the average value of the correctly signed $[V(t)]^2$ will maximize at 0.0852 when A/B is 1.70 and phase angle is $\pi/2$, (3) the average value of the correctly signed $[V(t)]^4$ will maximize at 0.117 when A/B is 2.30 and phase angle is $\pi/2$, and (4) the average value of the correctly signed $([V(t)]^2 - 0.3[V(t)]^4)$ will maximize at 0.051 when A/B=1.61 and the phase angle is $\pi/2$. This last function was selected because it appears to mimic the actual functionality of the ion mobility of some types of ions at high electric field strength. Note however that this last function has a second derivative that is negative over a small region between zero and one. These paragraphs of detailed description have been included in this document in order to enable a person skilled in the art to exactly understand the scope and limitations in selecting functions to be used to optimize the waveform generator, and to show that the 'rules' of the functions regarding signs and derivatives were given above to enable a less-skilled individual to select a function that will work with FAIMS. It is clear that a wider allowable set of functions is available, beyond the 'rules' described above, but a selection of these additional functions requires a complete understanding of the operation of FAIMS. These notes are also intended to allow a skilled individual to select a function that will yield a waveform having extended advantages, not limited by the 'rules' outlined above. For more clarity, the function applied to processing the optimization of the waveform can be tailored to match the

change in the mobility of the ion in strong electric fields, and the CV can thus be maximized.